SCIENCE LESSON PLAN
KIMCHI
GRADE 5

DATE: 06/13/2012
LESSON TOPIC: Using Rotation to Discover Day and Night, and Time Zones

OBJECTIVES/STUDENT LEARNING OUTCOMES:
- Students will be able to define *rotation.*
- Students will be able to diagram and describe the cause of day and night.

GRADE LEVEL INDICATORS:
- ESS 1. Describe how day and night are caused by Earth's rotation.

MATERIALS NEEDED:
- Student Pages, Somewhere in the World Right Now; Where is the Sun? Make a Picture Book.
- Copy of "Somewhere in the World Right Now" by Stacey Schuett
- Globes (1 per group)
- Lamps (1 per group)

INSTRUCTIONAL STRATEGY:
- Inquiry Engage, Explore, Explain, Elaborate, Evaluate
- Picture Perfect Science: Chapter 18 "Day and Night" Pages 251-257

STUDENT GROUPING:
- Whole class discussion
- Small group investigation

TEACHER-STUDENT INTERACTION:
- Engage Students with several clocks set a different times around the world.
- Read "Somewhere in the world Right Now"
- Write the following question on the board, asking students to form a hypothesis.
- ***How does the Earth move? What do the movements of the Earth have to do with how we keep time? Which movement do you think causes day and night?***
- Call on 2-3 students to share their responses.
- Explain that students are going to **use a lamp as a model of the Sun and the globe as a model of the Earth** to determine the cause of day and night:
- Pass out Somewhere in the world student pages.
- Students will use the lamp and globe to answer the questions on the student H.O.
- Lead a discussion that relates the exploration to the cause of day and night. Write corresponding **notes**:
  - The earth rotates (spins) on its axis (an imaginary line running through the middle of the earth).

- As it spins, it faces the sun and then does not face the sun (even though one half of it is facing the sun at any given time).
- Use a globe and rotate it around the "sun" to note times of day at a fixed location.
- When it is facing the sun, it is day. When it is facing away from the sun, it is night.
- "Is it daytime at the same time everywhere on earth? Use details to support your answer."

- Draw a diagram on the board to demonstrate sunrise, day, sunset, and night.
- Write the following question on the board, asking students to write a hypothesis
- ***How many different ways are there to tell time?***
- Call on 2-3 students to share their responses. There are several possible astronomy-related answers to the question:
  - The position of the sun in the sky
  - The length/direction of shadows formed by objects
- "Keeping track of time has been an important part of human culture since the beginning. Even primitive people were able to keep track of time by using the Sun as a guide. In earlier times, the amount of sunlight dictated which activities could be completed. Sandglasses were used before the 14th century. These devices were used to measure periods of time as opposed to telling the time. Another early timing device was the candle clock. Intervals were marked on the candle and the passage of time could be calculated as each interval burned. These candles could be turned into timers. A nail could be stuck into the candle at the point where the person wanted to be notified. When the wax around the nail melted, the nail would drop onto a metal plate, making a noise that alerted the person that time was up!
- "What do we know about the cause of day and night? [A day is measured in the amount of time it takes the Earth to rotate once on its axis]. Egyptians use this idea of rotation to make a sundial. The **Egyptian sundial** from 1500 B.C. is the first evidence found of a device that has the day divided into equal parts. A sundial uses shadows from the sun to determine the time of day."
- Explain that students are going to do an investigation to determine how they can use their own shadows to determine the time of day. Go outside and complete the first reading. Return every 30 minutes.
- Discuss how sundials measure time:
  - As the earth rotates, it faces the sun at different angles.
  - Shadows change when the sun's angle changes (demonstrate with a lamp).
  - We learned that the sun follows the same general path each day. Since we know this, the length/direction of our shadows would be approximately the same at the same time on any given day.
- "Time is measured in 24-hour periods. Those are broken into two 12-hour periods, then hours, then minutes, then seconds. The two 12-hour periods are called ante meridiem (a.m.) and post meridiem (p.m.). Ante meridiem is the time before midday; post meridiem is the time after midday. Noon is the moment when the Sun has reached its greatest angle measure from the horizon. This way of telling time is a Roman invention. Lawyers had to appear in court before noon in Roman times. A person was assigned to watch the Sun and announce to the forum when it crossed the meridian.

- "Because everyone wants the Sun to cross the meridian at noon, time zones were created. All people in a given time zone set their clocks the same way, and each zone is 1 hour different from the next. The zones are divided at every 15 degrees longitude, beginning with the Greenwich Meridian (Prime Meridian). Time at this point is called Greenwich Mean Time or Universal Time. There are four time zones in the continental United States: Eastern, Central, Mountain, and Pacific. "Is everyone's shadow the same length/pointing in the same direction at the same time everywhere on earth? [no because the earth's rotation makes the sun 'rise' at a different time in every place on the world]."

EVALUATING STUDENT LEARNING:

Make a picture book. Use Rubric to score.

Text: Picture Perfect Science Lessons- Using Children's books to Guide Inquiry, 3-6 by Karen Rohrich Ansberry and Emily Morgan.

Day and Night

Description

Using a model, learners explore time zones and what causes day and night and how time zones change. Learners observe the position of the Sun in the sky at different times of day and relate those positions to the rotation of the Earth.

Suggested Grade Levels: 4–6

Lesson Objectives Connecting to the Standards

Content Standard A: Science as Inquiry

K–4: Ask a question about objects, organisms, and events in the environment.

K–4: Use data (observations) to construct a reasonable explanation.

5–8: Develop descriptions, explanations, predictions, and models using evidence.

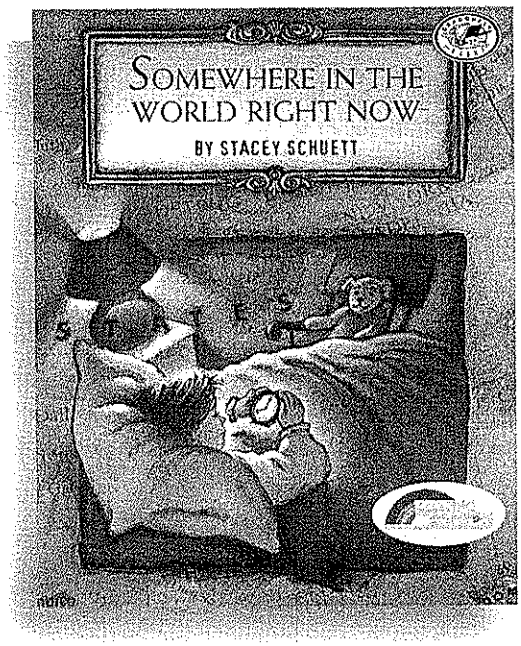
Content Standard D: Earth and Space Science

K–4: Understand that objects in the sky have patterns of movement. The sun appears to move across the sky in the same way every day, but its path changes slowly over the seasons.

5–8: Understand that most objects in the solar system are in regular and predictable motion. Those motions explain such phenomena as the day, the year, phases of the moon, and eclipses.

Featured Picture Book

Title	***Somewhere in the World Right Now***
Author	**Stacey Schuett**
Illustrator	**Stacey Schuett**
Publisher	**Dragonfly Books**
Year	**1997**
Genre	**Story**
Summary	**Describes what is happening in different places around the world at a particular time**



Time Needed

This lesson will take several class periods. Suggested scheduling is as follows:

Day 1: **Engage** with read aloud of *Somewhere in the World Right Now*

Day 2: **Explore** and **Explain** with modeling with lamps and globes

Days 3–5: **Elaborate** with Where Is the Sun?

Day 6: **Evaluate** with Make a Picture Book

Materials

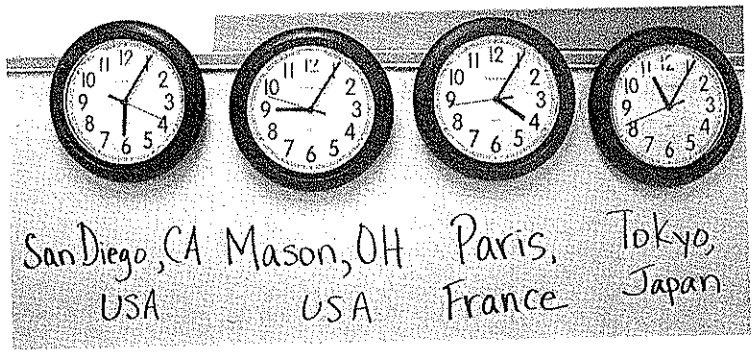
- Several clocks set at different times labeled with city and country
- Globes (1 per group)
- Lamps (1 per group)

Student Pages

- Somewhere in the World Right Now
- Where Is the Sun?
- Make a Picture Book

Engage

Before class, bring in several clocks set at different times around the world and label them with the city and country. You can find times of many cities around the world at *www.timeanddate.com/worldclock*.



Questioning

Introduce the author and illustrator of *Somewhere in the World Right Now*. Skip "A Note to the Reader" in the front of the book (this section will be used later to provide the scientific explanation for the students), and read the book aloud to students. Model the questioning skills of a good reader by asking the following types of questions as you read.

- ? Is it true that somewhere in the world it is already tomorrow?
- ? How can the Sun be rising and setting at the same time?
- ? How can all of these things be happening in the world right now?

Making Connections: Text-to-Self

Ask students

- ? Do you know someone who lives in a different part of the country or world where it is a different time than it is here?
- ? Have you ever been to a place where you had to set your watch differently?

Have students examine the clocks set for different times for different places in the world. Determine students' prior knowledge and misconceptions about Earth-Sun relationships by asking them to share ideas about how it can be so many different times at the same moment.

Explore & Explain

Modeling with Lamps and Globes

Provide each group of students with a lamp and a globe. Tell them they are going to use the lamp as a model of the Sun and the globe as a model of the Earth.

Before they begin the activity, ask students

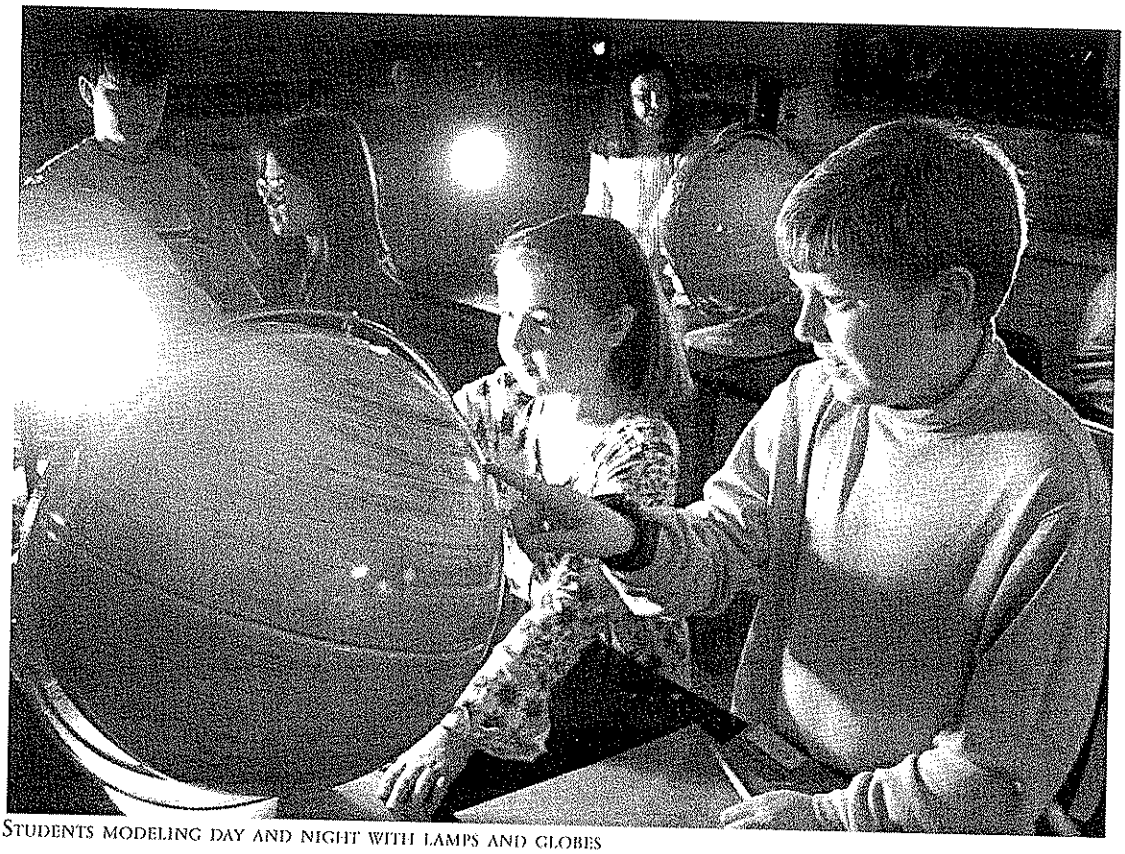
- ? How does the Earth move? (It rotates on its axis and revolves around the Sun.)
- ? What do the movements of the Earth have to do with how we keep time? (One rotation is one day and one revolution is one year.)
- ? Which movement do you think causes day and night? (Earth's rotation)

Then give students a few minutes to explore the following question with the model:

- ? How can it be different times in different places on the Earth?

After students have had time to explore the model, pass out the Somewhere in the World Right Now student pages. Tell students to use the lamp and globe to answer the questions on the student pages.

Discuss the student responses on the Somewhere in the World Right Now student pages. Have students share any observations, answers, and questions.



STUDENTS MODELING DAY AND NIGHT WITH LAMPS AND GLOBES

The correct answers for the student pages follow.

List three locations that are experiencing night when it is daytime in your city. (Answers will vary but should be locations on the opposite side of the globe.)

Can the Sun be rising and setting at the same time? Explain. (Yes. It is always rising somewhere on the Earth and setting on the opposite side of the Earth at the same time.)

Where on the globe is the international date line? (It runs through the middle of the Pacific Ocean in a north-south direction.)

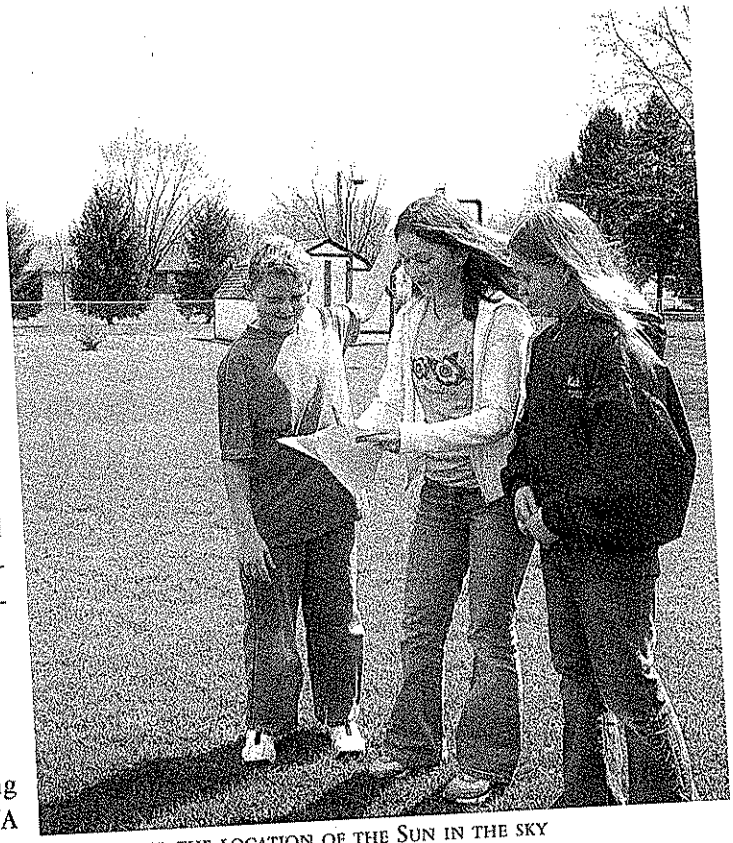
Why do you think the international community agreed to place the international date line in that location? (To have a date change in the middle of a country would cause too many problems for people living there. There aren't very many people living in the middle of the Pacific Ocean, so few people are affected by the change of date there.)

Which locations are first to begin the new day? (Places west of the international date line move into the new date first. Those locations include New Zealand, Russia, and Japan.)

Which locations are last to see the sunrise on that day? (Locations just east of the international date line are last to see the sunrise on a particular day. Those locations include Hawaii, Marquesas, and the Aleutian Islands.)

Which part of the United States is the first to see the sunrise, the East Coast or the West Coast? (the East Coast)

8 Think back to the book *Somewhere in the World Right Now*. On the lines below, explain how all of the events in the book could be taking place in the same moment. (All of those events were happening at the same moment because different places have different times based on location. Somewhere right now it is day and somewhere else right now it is night because the Sun lights up half of Earth at all times. As Earth rotates, different locations enter the sunlight at different times.)



LOOKING FOR THE LOCATION OF THE SUN IN THE SKY

Determining Importance

Tell students you will be reading an informational page titled "A Note to the Reader" from the front of *Somewhere in the World Right Now*. Have students listen for answers to any questions they might still have about time zones, the international date line, and Earth's rotation.

Elaborate

Where Is the Sun?

Distribute the Where is the Sun? student pages. Have students choose a location where they can face south and observe the Sun in the morning, at noon, and in the afternoon. Students will record the position of the Sun relative to a landmark at each of these times for three days.

SAFETY

Never look directly at the Sun! Looking at the Sun can damage your eyes!

After the third day, students can answer the questions on the Where Is the Sun? student pages. Have them revisit the lamp and globe model to reinforce their understanding of the abstract concepts they are learning with a concrete representation. Then discuss the questions from the student pages together.

Did you notice any patterns in where you saw the Sun in the sky each day? (Students should notice that the Sun is always lowest in the eastern sky in the morning, highest in the sky at noon, and lowest in the western sky in the afternoon.)

At what time of day did the Sun seem highest in the sky? (noon)

Think back to the globe and lamp you used to model day and night. Does the

Sun really move across the sky during the day? Explain. (No, in our model, the Sun stayed in the same place and the globe was rotating.)

How does the rotation of the Earth affect the appearance of the Sun in the sky in the morning, at noon, and in the afternoon? (In the morning, my location is turning toward the Sun. It appears in the east because of the direction the Earth turns. At noon, my location is turned all the way toward the Sun, so it appears to be right above me. In the afternoon, my location is turning away from the Sun. It appears in the west because of the direction the Earth turns.)

Evaluate

Make a Picture Book

Pass out the Make a Picture Book student page. Tell students they will be writing and illustrating a children's picture book that can be used to explain what causes day and night, and what causes the Sun to appear to move across the sky each day. Their finished products should include simple text, colorful illustrations, and clearly labeled diagrams.

Have available some picture books about astronomy written for young children, such as *The Sun is My Favorite Star* by Frank Asch and *The Moon Book* by Gail Gibbons. Share some examples of simple text, colorful illustrations, and clearly labeled diagrams.

Scoring Rubric for Make a Picture Book

4 Point Response	The picture book includes an accurate explanation of what causes day and night, a clearly labeled diagram showing what causes day and night, an accurate explanation of what causes the Sun to appear to move across the sky each day, a clearly labeled diagram of what causes the Sun to appear to move across the sky each day, simple text, and colorful, scientifically accurate illustrations.
3 Point Response	The student demonstrates a flaw in understanding of the concepts OR the book is missing one or two required elements.
2 Point Response	The student demonstrates a flaw in understanding of the concepts AND the book is missing one or two required elements; OR the student demonstrates understanding, but the book is missing three required elements.
1 Point Response	The student demonstrates a flaw in understanding of the concepts AND the book is missing three or more required elements; OR the student demonstrates understanding, but the book is missing four or more required elements.
0 Point Response	The book shows no understanding of the concepts AND is missing all required elements; OR the student did not make a book.

Inquiry Place

Have students brainstorm "investigatable" questions such as

> How does the length of daylight in summer compare to the length of daylight in winter where you live?
>
> How does the length of daylight in summer compare to the length of daylight in winter at the North Pole? How can you use a model to explain this difference?
>
> How do the direction and length of your shadow in the morning compare to its direction and length at noon or in late afternoon?

Students can select a question to investigate as a class, or groups of students can vote on the question they want to investigate as teams. Students can present their findings at a poster session.

More Books to Read

Branley, F. M. 1986. *What makes day and night?* New York, NY: HarperTrophy.
Summary: A simple explanation of how the rotation of the Earth causes day and night.

Dolan, G. 2001. *The Greenwich guide to day and night.* Chicago, IL: Heinemann Library.
Summary: Photographs, diagrams, and clear text answer questions such as: How long does it take for the Sun's light to reach Earth? How can shadows help us tell time? What is a solar eclipse?

Dolan, G. 2001. *The Greenwich guide to measuring time.* Chicago, IL: Heinemann Library.
Summary: Photographs, diagrams, and clear text answer questions such as What do we call the length of time for the Earth to go around the Sun? How do astronomers use stars to tell the time? Why do we have leap years?

Fletcher, R. 1997. *Twilight comes twice.* Boston, MA: Houghton Mifflin.
Summary: Free-verse text describes the transition from day to night and from night to day, revealing the magic in these everyday moments.

Web Sites

Virtual Globe: Areas of Sunlight and Darkness Updated Every Five Minutes

www.anutime.com/globe/3Den.html

World Clock

www.timeanddate.com/worldclock

References

Asch, F. 2000. *The Sun is my favorite star.* New York, NY: Harcourt.

Gibbons, G. 1997. *The Moon book.* New York, NY: Holiday House.